

Claims

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- 5                    1.            A clad-pumped, double clad, fiber laser, comprising:  
                         one or more cores disposed within a pump cladding;  
                         each core doped with a rare earth lasing ion;  
                         each core having an oblong cross section;  
                         there being either (a) a single core or (b) a central core and  
                         additional cores disposed outwardly of said central core, oriented in  
                         an array along a line inclusive of the center of said cladding with their  
                         long axes perpendicular to said line and with an equal distance  
                         between the centers of adjacent cores;  
10                    thereby to provide a linearly polarized output laser beam;  
                         there being a mode discriminating core characteristic selected  
                         from (c) index of refraction, (d) gain, and (e) cross sectional  
                         dimension, said characteristic, in a fiber having a single core, being  
                         greatest at the center of said single core and progressively lower  
15                    toward the periphery of said single core, said characteristic of said  
                         central core, in a fiber having additional cores, being greater than said  
                         characteristic of all others of said cores, said characteristic of each  
                         one of said other cores being lower than said characteristic of any of  
                         said cores that are closer to said central core than said one of said  
20                    cores;  
                         thereby causing radiation in said cores to phase-lock and  
                         transfer laser power coherently into a linearly polarized, bright laser  
                         beam of the fundamental in-phase supermode from all higher order  
                         supermodes belonging to the same array structure.
2.            A clad-pumped, double clad, fiber laser, comprising:  
                         one or more cores disposed within a pump cladding;

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each core doped with a rare earth lasing ion;  
there being either (a) a single core or (b) a central core and  
5 additional cores disposed outwardly of said central core;  
there being a modal discriminating core characteristic selected  
from (c) index of refraction, (d) gain, and (e) cross sectional  
dimension, said characteristic, in a fiber having a single core, being  
greatest at the center of said single core and progressively lower  
10 toward the periphery of said single core, said characteristic of said  
central core, in a fiber having additional cores, being greater than said  
characteristic of all others of said cores, said characteristic of each  
one of said other cores being lower than said characteristic of any of  
said cores that are closer to said central core than said one of said  
15 cores;  
thereby causing radiation in said cores to phase-lock and  
transfer laser power coherently into a bright laser beam of the  
fundamental in-phase supermode from all higher order supermodes  
belonging to the same array structure.

3. A laser according to claim 2 wherein:  
there are a plurality of cores with the center to center spacing  
of said cores being between 15 and 50 microns.

4. A laser according to claim 2 wherein:  
the cross section of said pump cladding is circular.

5. A laser according to claim 2 wherein:  
the cross section of said pump cladding is rectangular.

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- 5 6. A laser according to claim 2 wherein:  
each core has an oblong cross section;  
there being either (f) only one core or (g) a plurality of cores  
oriented in an array along a line inclusive of the center of said  
cladding with their long axes perpendicular to said line and with an  
equal distance between the centers of adjacent cores;  
thereby to provide a linearly polarized output laser beam.
7. A laser according to claim 2 wherein:  
there is only one core.
8. A laser according to claim 2 wherein:  
there are a plurality of said cores are arranged isometrically in  
at least one ring surrounding said central core.
9. A laser according to claim 8 wherein:  
there is only one ring of six cores surrounding said central  
core.
10. A laser according to claim 8 wherein:  
there is a first ring of six cores surrounding said central core  
and a second ring of twelve cores surrounding said first ring.
11. A laser according to claim 2 wherein:  
said characteristic is index of refraction.
12. A laser according to claim 2 wherein:  
there are a plurality of cores and said characteristic is gain.

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13. A laser according to claim 2 wherein:  
there are a plurality of cores and said characteristic is cross  
sectional dimension.

14. A clad-pumped, double clad, fiber laser, comprising:  
one or more cores disposed within a pump cladding;  
each core doped with a rare earth lasing ion;  
each core having an oblong cross section;  
5 there being either (a) a single core or (b) a central core and  
additional cores disposed outwardly of said central core, oriented in  
an array along a line inclusive of the center of said cladding with their  
long axes perpendicular to said line and with an equal distance  
between the centers of adjacent cores;  
10 thereby to provide a linearly polarized output laser beam.

15. A laser according to claim 14 wherein:  
there is only one core.

16. A laser according to claim 14 wherein:  
there are a plurality of cores with substantially the same  
cross sectional area as each other of said cores.

17. A laser according to claim 14 wherein:  
there are a plurality of cores with substantially the same  
refractive index.

18. A laser according to claim 14 wherein:  
there are a plurality of cores, said cores having a  
characteristic selected from (a) index of refraction, (b) gain, and (c)

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5 cross sectional dimension, said characteristic of said central core  
being greater than said characteristic of all others of said cores, said  
characteristic of each one of said other cores being lower than said  
characteristic of any of said cores that are closer to said central core  
than said one of said cores;

10 thereby causing radiation in said cores to phase-lock and  
transfer laser power coherently into a bright laser beam of the  
fundamental in-phase supermode from all high order supermodes  
belonging to the same array structure.

19. A laser according to claim 14 wherein:  
there are a plurality of cores, the center to center spacing of  
said cores is between 15 and 50 microns.

20. A laser according to claim 14 wherein:  
said pump cladding has a circular cross section.

21. A laser according to claim 14 wherein:  
each core is rectangular.

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